Review Comments
Technical Memorandum on Candidate Technologies
Rolling Knolls Landfill Superfund Site
Chatham, New Jersey
Document Dated March 2012, Revised March 2015

Following are the CDM Federal Programs Corporation's (CDM Smith) comments on the document titled, Technical Memorandum on Candidate Technologies (TMCT), Rolling Knolls Landfill (RKL) Superfund Site, Chatham, New Jersey, prepared by ARCADIS. The purpose of CDM Smith's review was to verify that the preliminary screening of remedial technologies and process options adequately address the contamination present in soil and groundwater media at the RKL site.

The following comments on the TMCT are specific to identification of general response actions and candidate remedial technologies and screening of remedial technologies and are based solely on review of the TMCT.

General Comments:

General Comment 1: The TMCT would benefit from a discussion of anticipated future land uses, including risk drivers and exposure pathways for both human health and ecological receptors, followed by the introduction of preliminary remedial action objectives (RAOs) and preliminary remedial goals (PRGs) for the site. RAOs and PRGs are generally formulated prior to the development of general response actions. The preliminary set of RAOs and PRGs can be finalized once the BERA is approved by EPA.

General Comment 2: The TMCT indicates in Section 1.1 that the findings of the human health and ecological risk assessments will be used to refine the list candidate technologies. In Section 1.2, the TMCT states that it "*serves as a conservative screen of candidate technologies*" but further evaluation would be completed "*following approval of the risk assessment documents*." In Section 3.1, the TMCT states that the baseline human health risk assessment (BHHRA) was approved by EPA in 2014. In Section 3.2, the TMCT states that the screening-level ecological risk assessment (SLERA) was approved EPA in 2013. The 2015 TMCT should be revised to include the findings of the BHHRA and SLERA. In addition, the findings of these documents should be used to formulate the RAOs and PRGs. In turn, the RAOs and PRGs should guide the selection and evaluation of general response actions and remedial technologies for soil and groundwater.

General Comment 3: The TMCT states that some of the concentrations of polycyclic aromatic hydrocarbons (PAHs), phthalates, polychlorinated biphenyl (PCBs), pesticides and inorganics exceed New Jersey (NJ) Residential and Non-Residential Soil Remediation Standards (SRS). However, the TMCT does not specify which contaminants in particular exceed those standards. The TMCT remedial technology selection is biased to volatile organic compounds (VOCs) and inorganics although other contaminant classes have been detected at the site and presumably exceed the NJ SRS.

General Comment 4: Some description of the landfill conditions, including landfill caps and bottom liners, if any, will provide the basis of the GRA and technology identification and evaluation. Additionally, the TMCT has not discussed and/or evaluated the closure and post-closure of the landfill, which is a regulatory requirement.

General Comment 5: There are sections of the document that repeat discussion points. Those sections should be rewritten to focus on the specific media that section is intended to discuss. Alternatively, the report could be reorganized to target remediation of the landfill as one unit, and then other technologies to treat downgradient GW plume. That could also eliminate a lot of the repetition.

General Comment 6: The remedial technologies with accompanying process options in tables 2,3,4 and 5 should match descriptions of technologies presented in the text. How In-situ Physical Treatment is presented in the text versus the tables is an example.

Specific Comments:

Section 1.2 Objectives, Second Paragraph: As stated previously, the BHHRA was submitted and approved by EPA in June 2014. The SLERA was approved by EPA in April 2013. Indicate what remaining risk assessment documents will be completed or if any revisions are expected.

Section 1.2 Objectives, Second Paragraph: Please include a time frame for completion of assessment of site environmental conditions. Major data gaps that need to be addressed from previous investigations should be included in the description of the remaining site assessment activities.

Section 2.3 Investigative History, Third Main Bullet, First Sub Bullet, First Paragraph: Background samples should be presented to substantiate the statement that the occurrence of aluminum, iron, and manganese is widespread and are present in parent rocks from which surficial soils have originated and therefore not suggestive of a point source release near MW-7.

Section 3 Exposure Setting: This section should provide a summary of the major risk drivers and exposure pathways identified in the human health and ecological risk assessments. This information will form the basis for the development of the RAOs and PRGs, and also the identifications and evaluations of the GRAs and technologies.

Section 4.1 Feasibility Study Process Overview, First Paragraph: In addition to the referenced USEPA guidance, the TMCT should also consider OSWER Directive No. 9355.0-49FS – *Presumptive Remedy for CERCLA Municipal Landfill Sites*. The presumptive remedy is primarily source containment including cover system, source-area groundwater control, and institutional controls to supplement engineering controls.

Section 4.1.1 Identification of General Response Actions, Bulleted List: Monitoring should be included as an applicable general response action. Containment actions would require periodic site monitoring and reporting of site conditions and cover integrity. In addition, monitoring reports would be included in Five-Year site reviews.

Ex situ treatment of soil should be included as an applicable general response action.

Section 4.1.2 Remedial Technologies and Process Options, Second Paragraph, First Sentence: The text states that "*considering all potentially applicable technologies and process options initially minimizes the likelihood that an applicable technology(ies) gets overlooked early in the FS process*." However, the preliminary screening of remedial technologies for both soil and groundwater media failed to incorporate numerous applicable technologies based on the summary of contaminant distribution in Section 2.3.

An example list of potentially applicable treatment technologies can be found on Table 3-2 Treatment Technologies Screening Matrix from the Federal Remediation Technologies Roundtable (FRTR) Remediation Technologies Screening Matrix and Reference Guide, Version 4.0 (www.frtr.gov/matrix2/top_page.html)

The technologies evaluated appear to be limited to VOCs and inorganics. Remedial technologies screened did not consider the presence of semi-volatile organic compounds (SVOCs), PAHs, PCBs, and pesticides. Future treatment scenarios may need to incorporate a treatment train that may include multiple technologies to address the range of constituent classes. Additional remedial technologies should be considered for these constituents in soil and groundwater media. The description of the process option should state what constituent class(es) would be treated by the remedial technology.

Section 4.2 Remedial Technology Descriptions for Soil, General Comments: Typical remedial technologies associated with in situ and ex situ treatment of contaminated soil were not considered. Section 4.1.2 stated that "*considering all potentially applicable technologies and process options initially minimizes the likelihood that an applicable technology(ies) gets overlooked early in the FS process*." Include all potentially applicable in situ and ex situ soil treatment technologies in Section 4.2, Table 2 and Table 4.

Note, where appropriate, which process options and remedial technologies would apply to both soil and groundwater impacted media. For example, covers are included as general process options for both media. Use consistent terminology between the two screening sections.

Section 4.2.2 Institutional Controls, First Paragraph: This section should be written specifically for the soil media.

Section 4.2.4 Containment – Soil Capping, First Paragraph, Last Sentence: Explain what adverse impacts construction of a cover system over the entire site using standard construction techniques has on the surrounding neighborhood. Section 2.1.1 states that the surrounding area is sparsely populated.

Section 4.2.4 Containment – Soil Capping, Vegetative Cover Bullet: The description includes specific thicknesses for compacted soil and top soil. Recommend removing the specific thicknesses called out unless there is a site-specific basis provided; for example, a Hydrologic Evaluation of Landfill Performance (HELP) model developed using site-specific parameters.

Section 4.2.4 Containment – Soil Capping: The other technologies presented are technology descriptions and do not elaborate on disadvantages. Remove the discussion of disadvantages or add disadvantage sections to the other technologies discussed.

Section 4.2.4 Containment – Soil Capping: Vegetative cover: Although the cap would experience evaporation, vegetative covers in temperate areas like New Jersey are generally used to provide a physical barrier to prevent human and ecological contact and promote runoff to limit infiltration through positive drainage. Infiltration will occur during wet periods and the non growing season.

Section 4.2.4 Containment – Soil Capping, Impermeable Cover Bullet: Refrain from using specific soil cover thickness in the absence of site-specific information. Explain how an impermeable cover with a 2-foot thick soil cover is an effective method for providing erosion control. At a minimum, the cover should meet landfill closure requirements.

Section 4.2.4 Containment – Soil Capping, Impermeable Cover: A degree of impermeabilty can also be obtained by construction of a low permeability clay layer coupled with the vegetative layer. Considering adding this option.

4.2.5 In-Situ Chemical Treatment: Please change the title of this subsection to "In-Situ Chemical/Physical Treatment". Stabilization can be both a chemical and physical treatment process. Solidification is primarily a physical treatment process.

Typically, auger mixing systems and vitrification are considered in situ solidification/stabilization remedial technologies. The description of stabilization and solidification should include a discussion of how in situ mixing of reagents would generally be accomplished.

Section 4.2.5 In-situ Chemical Treatment: Stabilization and solidification are generally only effective treatment for inorganics with the processes described. In some cases, organics can actually interfere with the chemical reactions of the stabilizer. Add the disclaimer similar to the statement at bottom of the page to the summary paragraph.

Section 4.2.6 Removal-Excavation and 4.2.7 Disposal: Since excavation is a requirement of all disposal options, the technologies should be combined and presented such as Excavation with off-site disposal, Excavation with consolidation and on site disposal and possibly Excavation with treatment and on-site disposal if ex-situ stabilization is considered.

4.2.6 Removal - Excavation: Consider the impact of landfill debris on the excavation process and subsequent pre-treatment, if needed, and disposal.

4.2.7 Disposal: Transportation of material for off-site should be considered a process option related to disposal.

Section 4.3 Remedial Technology Descriptions for Groundwater, General Comments: Typical remedial technologies associated with in situ and ex situ treatment of contaminated groundwater were not considered. Include all potentially applicable in situ and ex situ groundwater treatment technologies in Section 4.3, Table 3 and Table 5.

Note, where appropriate, which process options and remedial technologies would apply to both soil and groundwater impacted media. For example, covers are included as general process options for both media. Use consistent terminology between the two screening sections.

Section 4.3.2 Institutional Controls, First Paragraph: This section repeats much of the same discussion points as Section 4.2.2. This section should be written specifically for the groundwater media. Include groundwater use restrictions.

Section 4.3.3 MNA: The text should discuss if there are any indications that natural attenuation is occurring at the site.

Section 4.3.5 Containment – Barrier: Add a description of collection trenches.

Section 4.3.5 Containment – Barrier: It would be helpful to break this into two sections with different titles as they are substantially different technologies; barriers and permeable reactive barriers (PRBs) or present PRBs as an in-situ physical treatment.

Section 4.3.7 In-Situ Chemical Treatment: Consider adding a discussion of zero-valent iron.

Section 4.3.8 In-Situ Biological Treatment: Provide examples of carbon sources and oxygenates in the text. Also discuss bioagumentation.

Section 4.3.9 Ex-Situ –Physical Treatment: Change the title to Extraction and Ex-Situ Physical Treatment.

Table 2 Preliminary Screening of Remedial Technologies- Soil: Comments on Table 2 are as follows:

- The preliminary screening should consider all applicable process options and remedial technologies appropriate for all contaminant classes of concern.
- Monitoring needs to be added as a general response action. This would be a component of an on-site containment remedy.
- Include subsurface source controls as a remedial technology to the Containment general response action category. On-site containment may include construction of a liner system.
- Solidification/stabilization is a physical and chemical remedial technology. Change the remedial technology description to “Physical/Chemical”.
- Solidification/stabilization would also require containment. Mention that this process option would be used in conjunction with other technologies.
- Include other in situ physical and chemical soil remedial technologies. Soil vapor extraction is included as a groundwater process option. Soil vapor extraction would also be relevant to VOC soil contamination.
- Include other remedial technology categories including biological and thermal treatment.

- Include ex situ treatment as a general response action. Treatment technologies should consider all the contaminants of concern including inorganics, VOCs, SVOCs, PAHs, PCBs and pesticides.
- Recommend off-site incineration be retained as a process option unless it can be shown that contaminated soil would not be considered a characteristic hazardous waste or trigger land disposal restrictions. It does not appear from the text that a preliminary determination has been made.
- Explain why backfilling with unimpacted soil would require combination with other technologies such as capping and institutional controls. Removal of contaminated soil and backfilling with clean soil may result in an unrestricted use of site.
- Explain why ex situ treatments necessary to generate soil for reuse are not considered appropriate for the site.

Table 3 Preliminary Screening of Remedial Technologies - Groundwater: Comments on Table 3 are as follows:

- The preliminary screening should consider all applicable process options and remedial technologies for all contaminant classes of concern.
- Institutional controls may include groundwater use restrictions (NJ has Classification Exception Areas). Include groundwater use restrictions in the description of ICs.
- Monitoring needs to be added as a general response action. Groundwater sampling would be a component of a groundwater treatment process option.
- Use similar terminology for description of the soil cap process option for groundwater containment as is used in Table 2 for contaminated soil containment.
- Groundwater extraction may also provide hydraulic control of the contaminant plume.
- Groundwater recovery trenches may also provide hydraulic control of contaminated groundwater.
- State that ozone injection would be combined with collection of vapors.
- Chemical in situ remedial technologies are focused on oxidation of contaminants. Recommend adding in situ chemical/biological reduction technologies such as microscale and nanoscale emulsified zero-valent iron as a potential remedial technology.
- The description for enhanced reductive dechlorination states that native microorganisms would facilitate degradation. Enhanced reductive dechlorination could also be accomplished by bioaugmentation if native microorganisms are not present to facilitate biodegradation.
- Consider additional ex-situ groundwater treatment technologies to address the contaminants classes of concern. Future treatment scenarios may need to incorporate a treatment train that includes multiple technologies to address the range of constituent classes. Advanced oxidation processes should be considered as an ex situ treatment process option. Expand the precipitation process description option to include coagulation and flocculation.
- Sludge from precipitation/coagulation/flocculation processes would require disposal. The decision rationale should include potential sludge disposal restrictions.

Table 4 Process Options Screening - Soil: Comments on Table 4 are as follows:

- See comments on Table 2 concerning incorporating additional general response actions and in situ and ex situ soil remedial technologies to address other site contaminant classes. Include

discussion of the effectiveness of the remedial technologies to address the various contaminant classes.

- Rank the effectiveness, implementability and relative cost of No Action. No Action would have high implementability, but low effectiveness and relative cost.
- In-Situ Treatment: Solidification/stabilization has limited effectiveness for VOCs, SVOCs, PAHs and pesticides. In situ treatment would require significant mixing of contaminated soil with various additives to achieve the remedial goals.
- Consider the impact a large volume of contaminated soil may have on a receiving landfill for the off-site landfill disposal process option.
- On-site consolidation would likely require subsurface source control. Add subsurface source control under the containment general response action.
- Backfilling excavation should be retained for further evaluation. Although backfilling treated soil may not occur, backfilling with clean material may be included under an excavation and off-site disposal or an on-site consolidation scenario. Backfilling may be eliminated during remedial alternative development if a stated objective of the remediation alternative is to create open water areas, for example.

Table 5 Process Options Screening - Groundwater: Comments on Table 5 are as follows:

- See comments on Table 3 concerning incorporating additional general response actions and in situ and ex situ groundwater remedial technologies to address contaminant classes other than inorganics and VOCs.
- Evaluate the effectiveness, implementability and relative cost of No Action. No Action would have high implementability, but low effectiveness and relative cost.
- Correct the effectiveness statement for monitored natural attenuation (MNA). MNA is a process option that relies on natural processes to achieve a reduction of COCs within a reasonable time frame. The process option itself does not prevent the exposure pathway.
- Soil cap process option should use similar terminology as is used for the contaminated soil process options.
- The trenched cut-off wall process option appears to be eliminated from considered as it is shaded, but the cell for Yes or No was left blank. Please correct.
- Sheet piling should be considered a process option considered for further evaluation. Given the site conditions, it may be simpler to install sheet piling than a permeable reactive wall.
- Groundwater extraction was eliminated from further consideration but typical ex situ treatment process options were retained. Groundwater extraction is a typical process option for contaminated groundwater sites and should be considered for further evaluation. In addition, dewatering may be needed in combination with other process options.
- Clarify that soil vapor extraction removes VOCs from the vadose zone. Consider the thickness of the vadose zone and depth to groundwater table at the site when evaluating the effectiveness of this process option. Note that soil vapor extraction should be a soil treatment technology.
- Consider the ability to capture vapors at the site based on the depth to groundwater when evaluating the effectiveness of air sparging.
- In situ treatment technologies listed focus on VOCs. However, other contaminant classes such as PAHs, PCBs and pesticides are present. Consider the ability of the in situ treatment technologies

to address other contaminant classes when evaluating their effectiveness. Include additional in situ treatment technologies to address PAHs, PCBs and pesticides.

- Consider the ability of ex situ treatment technologies to address other contaminant classes when evaluating their effectiveness.
- The effectiveness of ion exchange is contaminant specific. Please explain why ion exchange has a high effectiveness.
- The implementability evaluation for the precipitation process option discusses sampling and disposal of sediment. The description should be corrected to cite sampling and disposal of sludge, not sediment.